PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-124873
(43)Date of publication of application : 06.05.1994

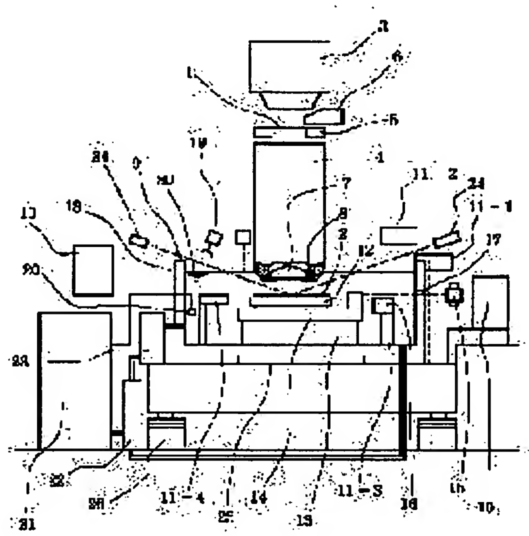
(51)Int.CI. H01L 21/027
G03F 7/20
G03F 7/20

(21)Application number : 04-296518
(22)Date of filing : 09.10.1992

(71)Applicant : CANON INC
(72)Inventor : TAKAHASHI KAZUO

(54) LIQUID-SOAKING TYPE PROJECTION EXPOSURE APPARATUS

(57)Abstract:
PURPOSE: To improve resolution and focus depth by applying a liquid soaking method for putting high refractive liquid index liquid between an objective lens of a microscope and a sample to a projection exposure apparatus as production equipment.
CONSTITUTION: A projection exposure apparatus comprises a illuminating means 3 for illuminating a reticle 3, an optical projecting means 4 for projecting a pattern on the reticle 1 illuminated by the illuminating means 3 onto a wafer 2 and positioning means 11-1 to 11-4 for positioning the wafer 2 on a predetermined position. The optical projecting means 4 comprises an optic element 7 opposite to an exposed face of the wafer 2 having a plane or a protruding face protruding toward the wafer 2 and a liquid reservoir 9 for holding liquid 30 which at least fills a space between the plane or the protruding face of this optic element 7 and the exposed face of the wafer 2. Thus a liquid soaking method which improves resolution and focus depth can be applied to an exposure apparatus, so that an inexpensive exposure apparatus with which effect according respective wavelengths irrespective of a wavelength of an exposure light source can be expected can be obtained.



LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the projection aligner equipped with a lighting means to illuminate a reticle, a projection optics means to project on a wafer the pattern on the reticle illuminated by this, and a positioning means to position a wafer in a predetermined location a projection optics means counters the exposure side of a wafer, and is **** in a flat-surface or wafer side -- the immersion type projection aligner characterized by providing the cistern for holding the liquid which fills at least between the optical element which has a convex and the flat surface of this optical element, or convexes and the exposure sides of a wafer.
[Claim 2] An alignment measurement means by which a positioning means detects a wafer location, and a focal location detection means to detect the location of the wafer exposure side over the focal location of a projection optics means, The wafer driving means which holds and drives a wafer in the direction which leans X and the direction of Y parallel to the exposure side, the surrounding direction of theta of a shaft perpendicular to these, a Z direction, and a wafer in the direction of arbitration for a wafer, The immersion type projection aligner according to claim 1 characterized by having a wafer conveyance means to carry in a wafer on the maintenance location of a wafer driving means, and to take out.
[Claim 3] The optical element which counters a wafer is an immersion type projection aligner according to claim 2 which is a plane parallel plate.
[Claim 4] It is the immersion type projection aligner according to claim 2 characterized by for a projection optics means having a lens-barrel, attaching in the lower limit of the lens-barrel the optical element which counters a wafer, and having prepared the seal member between the optical element and lens-barrel.
[Claim 5] The optical element which counters a wafer is an immersion type projection aligner according to claim 2 characterized by the ability to move in the direction of an optical axis, and position in the location of arbitration.
[Claim 6] it is **** in a flat-surface [of the optical element which counters a wafer], or wafer side -- the immersion type projection aligner according to claim 2 characterized by having applied the liquid used for either [at least] a convex or the exposure side of a wafer in order to fill between these both sides, and the coating agent with ******.
[Claim 7] The top face of a cistern is an immersion type projection aligner according to claim 2 characterized by being released.
[Claim 8] A cistern is an immersion type projection aligner according to claim 2 characterized by constituting a closed space.
[Claim 9] A cistern is an immersion type projection aligner according to claim 8 characterized by having the aperture for wafer conveyance which can be opened and closed.
[Claim 10] A cistern is an immersion type projection aligner according to claim 8 which constitutes the vacuum chamber.
[Claim 11] The immersion type projection aligner according to claim 8 which has a pressure gage for detecting the pressure in a cistern.
[Claim 12] The pressurizer of the liquid supplied in a cistern, the immersion type projection aligner according to claim 8 which has at least one side among decompression devices.
[Claim 13] The immersion type projection aligner according to claim 8 which has the pressurization means of the liquid in a cistern.
[Claim 14] A cistern is an immersion type projection aligner according to claim 7 or 8 characterized by being fixed in location to an optical means.
[Claim 15] A wafer driving means is an immersion type projection aligner according to claim 7 or 8 which has an X-Y stage for moving a wafer in X parallel to the exposure side, and the direction of Y, and its

driving means, and is characterized by fixing the cistern to an X-Y stage in location.
[Claim 16] It is the immersion type projection aligner according to claim 14 or 15 which a wafer driving means has an X-Y stage for moving a wafer in X parallel to the exposure side, and the direction of Y, and its driving means, and is characterized by locating the mechanical component of an X-Y stage in the exterior of a cistern.
[Claim 17] It is the immersion type projection aligner according to claim 7 or 8 which a wafer driving means has the jogging stage which leans the X-Y stage and wafer for moving a wafer in X and the direction of Y in the direction of arbitration, and is characterized by arranging the cistern on an X-Y stage.
[Claim 18] It is the immersion type projection aligner according to claim 17 characterized by arranging a jogging stage in a cistern, and for the cistern consisting of ingredients with high permeability, and carrying out magnetic coupling of a jogging stage and the X-Y stage through a cistern.
[Claim 19] A cistern is an immersion type projection aligner according to claim 14 or 15 characterized by consisting of low-fever expansion ingredients.
[Claim 20] It is the immersion type projection aligner according to claim 14 or 15 which a positioning means has a means by which a laser interferometer detects a wafer location, and is characterized by a cistern having an aperture for this laser interferometer.
[Claim 21] It is the immersion type projection aligner according to claim 14 or 15 which a positioning means has a means by which a laser interferometer detects a wafer location, and is characterized by fixing this laser interferometer to a cistern.
[Claim 22] The immersion type projection aligner according to claim 14 or 15 characterized by having the liquid supply control means which supplies a liquid to a cistern and controls the level and amount.
[Claim 23] A liquid supply control means is an immersion type projection aligner according to claim 22 characterized by having a means to filter the liquid to supply.
[Claim 24] An immersion type projection aligner [equipped with a means to excite the liquid filled by the cistern] according to claim 14 or 15.
[Claim 25] The immersion type projection aligner according to claim 14 or 15 which has a means to excite a wafer.
[Claim 26] The immersion type projection aligner according to claim 14 or 15 which has a means to excite the optical element which counters a wafer.
[Claim 27] An excitation means is an immersion type projection aligner according to claim 25 or 26 which is ultrasonic excitation equipment.
[Claim 28] An immersion type projection aligner [equipped with a temperature control means to measure and control the temperature of the liquid supplied in the cistern] according to claim 14 or 15.
[Claim 29] An immersion type projection aligner [equipped with a refractometry means to measure the refractive index of the liquid supplied in the cistern] according to claim 14 or 15.
[Claim 30] An immersion type projection aligner [equipped with the stabilizer which prevents a flow of the liquid supplied in the cistern] according to claim 14 or 15.
[Claim 31] The outer wall of a cistern is an immersion type projection aligner according to claim 14 or 15 covered by the heat insulation member.
[Claim 32] It is the immersion type projection aligner according to claim 14 or 15 which a wafer driving means is equipped with the wafer chuck which adsorbs a wafer and holds it, and is characterized by this wafer chuck having the shutter which prevents that a liquid flows the path for carrying out vacuum suction and adsorbing a wafer, and in this path.
[Claim 33] It is the immersion type projection aligner according to claim 14 or 15 with which a wafer driving means is equipped with a wafer conveyance means to carry in a wafer to the exposure location in a cistern, and to take out, and the conveyance means of this wafer is characterized by arranging at least the part in a cistern.
[Claim 34] A conveyance means is an immersion type projection aligner according to claim 33 which has the means which carries in a wafer to the liquid held in the cistern perpendicularly or aslant, and levels a wafer in a liquid.
[Claim 35] The immersion type projection aligner according to claim 33 which has the means which acts as Ayr Breaux at least of one side of a wafer in case a wafer is taken out out of the liquid with which the conveyance means was held in the cistern.
[Claim 36] The immersion type projection aligner according to claim 14 or 15 characterized by having the pump which supplies a liquid in a cistern and is made to discharge. ******.
[Claim 37] It is the immersion type projection aligner according to claim 7 or 8 which has the jogging stage

which a wafer driving means is moved in X and the direction of Y by the X-Y stage and this which move in X and the direction of Y, and leans a wafer in the direction of arbitration, and is characterized by fixing the cistern on a jogging stage.

[Claim 38] The immersion type projection aligner according to claim 37 characterized by the base of a cistern constituting the wafer chuck holding a wafer.

[Claim 39] The immersion type projection aligner according to claim 37 characterized by consisting of flat surfaces at which at least 2 side faces of a cistern intersected perpendicularly, and these flat surfaces constituting the anti-slant face of a laser beam.

[Claim 40] The immersion type projection aligner according to claim 18 characterized by the bottom surface part material and jogging stage base of a cistern constituting the flat-surface guide of fluid bearing.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the immersion type projection aligner for exposing a detailed circuit pattern on a wafer in a semi-conductor production process.
[0002]
[Description of the Prior Art] Detailed-ization of a semiconductor device progressed and it has shifted to i line with short wavelength from g line of a high pressure mercury vapor lamp as the exposure light source conventionally. And since high resolution is needed more, NA (numerical aperture) of a projection lens must be enlarged and, for the reason, the depth of focus is in the inclination which becomes still shallower. These relation can be expressed with a degree type as generally known well.
= (Resolution) k1 (lambda/NA)
(Depth of focus) =**k2 lambda/NA 2 -- the wavelength of the light source which uses lambda for exposure here, and NA -- NA (numerical aperture) of a projection lens, k1, and k2 It is a multiplier related to a process.
[0003] in recent years, it is called excimer laser with more short wavelength from g line of the conventional high pressure mercury vapor lamp, and i line (KrF, ArF) -- use of an X-ray is also considered further. Moreover, on the other hand, examination of the high resolution by the phase shift mask or deformation lighting and a raise in depth is also beginning to be made and used. however, it is called excimer laser -- having (KrF, ArF) -- as for the approach of using an X-ray, equipment cost becomes high, and a phase shift mask or deformation lighting has problems -- effectiveness may not be expectable with a circuit pattern.
[0004] Then, the attempt which applies the method of immersion is made. For example, the nozzle which encloses the tip of reducing glass and has liquid input in an aligner is prepared in JP,63-49893,B, a liquid is supplied through this, and what held the liquid between reducing glass and a wafer is indicated.
[0005]
[Problem(s) to be Solved by the Invention] However, in this conventional technique, a liquid is only merely supplied and it is a request, and in order to use it by the actual production process, it has various problems -- the conventional process technique cannot be employed efficiently.
[0006] In view of the trouble of the above-mentioned conventional technique, irrespective of the wavelength of the exposure light source used [excimer laser / g line, i line, or], the purpose of this invention offers the cheap immersion type aligner of the cost which can expect the effectiveness according to each wavelength on every wavelength, and aims at offering the immersion type aligner which can employ the further conventional process technique efficiently.
[0007]
[Means for Solving the Problem] A lighting means to illuminate a reticle in this invention in order to attain this purpose, In the projection aligner equipped with a projection optics means to project on a wafer the pattern on the reticle illuminated by this, and a positioning means to position a wafer in a predetermined location a projection optics means counters the exposure side of a wafer, and is **** in a flat-surface or wafer side -- the cistern for holding the liquid which fills at least between the optical element which has a convex and the flat surface of this optical element, or convexes and the exposure sides of a wafer is provided.
[0008] An alignment measurement means by which a positioning means usually detects a wafer location, A focal location detection means to detect the location of the wafer exposure side over the focal location of a projection optics means, The wafer driving means which holds and drives a wafer in the direction which leans X and the direction of Y parallel to the exposure side, the surrounding direction of theta of a shaft

perpendicular to these, a Z direction, and a wafer in the direction of arbitration for a wafer, It has a wafer conveyance means to carry in a wafer on the maintenance location of a wafer driving means, and to take out.

[0009] A cistern may constitute a closed space and may have the pressurization means of the liquid in a cistern etc. It may be fixed in location to an optical means, or the cistern may be fixed to the X-Y stage in location again. When the cistern is being fixed in location to the optical means, a jogging stage is arranged in a cistern, a cistern consists of ingredients with high permeability, and magnetic coupling of a jogging stage and the X-Y stage is carried out through a cistern.

[0010]

[Function] As an approach of raising the resolution of an optical microscope, the so-called immersion method which fills between an objective lens and samples with the liquid of a high refractive index is known from the former (for example, D.W.Pohl, W.Denk & M.Lanz, Appl.Phys.Lett.44652 (1984)). As an example which applied this effectiveness to the imprint of the detailed circuit pattern of a semiconductor device, there are "H.Kawata, J.M.Carter, A.Yen, H.I.Smith, Microelectronic Engineering 9 (1989)", or "T.R.Corle, G.S.kino, USP 5,121,256" (9 Jun. 1992). A last paper is what examined the effectiveness of dipping in exposure, the configuration as a practical semi-conductor aligner is not discussed, but the latter patent is indicating the approach of placing an immersion lens near the front face of a wafer.

[0011] According to this invention, this invention becomes possible [offering the aligner using the effectiveness of dipping] about the concrete approach for the projection aligner as a production facility to realize the approach of filling with the liquid of a high refractive index between the objective lens of the microscope known from the former, and samples.

[0012] It is lambda 0 as this "effectiveness of dipping". As it considers as the wavelength in the inside of the air of exposure light and is shown in drawing 10 , when make into the convergence half width of a beam of light the refractive index and alpha to the air of the liquid which uses n for dipping, and and it immerses, above-mentioned resolution and the above-mentioned depth of focus become like a degree type. [NA0 =sin] (Resolution) =k1/(lambda0 / n) NA0(depth of focus) =**k2 / (lambda0 / n) (NA0) 2, i.e., the effectiveness of dipping, has wavelength equivalent to using the exposure wavelength which is 1/n. When in other words the same projection optics of NA is designed, the depth of focus can be increased n times by dipping. This is effective also to the configuration of all patterns, and can still also be combined with the phase shift method by which current examination is carried out, deformation illumination, etc. In order to employ this effectiveness efficiently, the purity of a liquid, homogeneity, temperature, etc. need to be managed precise, and in the aligner which is exposed serially and goes by step-and-repeat actuation on a wafer, it becomes a problem how the air bubbles which remain on the wafer front face at the time of carrying in in a liquid to lessen a flow and vibration of the liquid generated working as much as possible and a wafer are removed. The configuration of the equipment for solving many of these problems is proposed, and it enables it to employ the effectiveness of dipping efficiently enough in this invention, so that an example may explain. Although the aligner of an X-ray or an electron beam (EB) was conventionally considered to be the need by production of DRAM of 256Mbit - 1Gbit from the conventional stepper which makes i line and excimer laser the light source, the manufacture process conventional by the conventional stepper which makes i line or excimer laser the light source can be diverted by this invention, and the advantageous production also in cost is attained in the manufacture process established technically.

[0013] Below, it explains more through an example at a detail.

[0014]

[Example]

Example 1 drawing 1 is the block diagram of the immersion type projection aligner concerning the 1st example of this invention. The wafer with which, as for one, a reticle is applied among drawing, as for 2, a sensitization agent is applied, and the circuit pattern on a reticle 1 is exposed and imprinted, The illumination-light study system equipped with a shutter, a dimmer, etc. for 3 to project the circuit pattern on a reticle 1 on a wafer 2, In order that the reticle stage for the projection optics to which 4 projects the circuit pattern on a reticle 1 on a wafer 2, and 5 holding a reticle 1, and positioning to a position, and 6 may position a reticle 1, And it is the alignment optical system for making a reticle image agree to the circuit pattern already imprinted on the wafer 2.

[0015] If the lens which counters wafer 2 front face of projection optics 4 will be called the 2nd optical element 7, the field which counters wafer 2 front face of this 2nd optical element 7 is constituted so that it may become a convex toward a flat surface or wafer 2 front face, as shown in drawing 2 and drawing 3 . In case this immerses, it is for making it neither an air space nor air bubbles remain in the 2nd optical element

7 front face. Moreover, as for the front face of the optical element 7 to immerse, and the front face of the sensitization agent on a wafer 2, it is desirable to perform the liquid 30 used for dipping and coating with ******. The seal 8 for preventing invasion to the lens-barrel of a liquid 30 is between the 2nd optical element 7 and the lens-barrel of projection optics 4. This seal is unnecessary, if it is made a configuration so that the function to manage the height which takes the thick thickness of the 2nd optical element 7 as shown in drawing 4 , and dips a liquid 30 may be added.

[0016] A cistern (chamber) for 9 to fill a liquid 30 and 10 A wafer cassette, A wafer chuck for 12 to hold a wafer 2 and 11-1 to 11-4 The rough pointing device of a wafer, An X-Y stage for 13 to position a wafer 2 to a position and 14 are jogging stages which have a tilt function for being arranged on an X-Y stage and amending the amendment function of the direction location of theta of a wafer 2, the adjustment function of Z location of a wafer 2, and the inclination of a wafer 2. There are some of wafer transport devices for carrying in a wafer from the wafer cassette 10 and setting on the wafer chuck 12 into a chamber 9, rough positioning devices 11-1 to 11-4 or the whole, the wafer chuck 12, X-Y stage 13, and a jogging stage 14.

[0017] Since the reference mirror which reflects the light of a laser interferometer 15 in order to attach 15 on the jogging stage 14 at a laser interferometer, to attach 16 in X and the direction (the direction of Y is un-illustrating) of Y and to measure the location of the jogging stage 14, and 17 pass the light of a laser interferometer 15, the aperture prepared in the chamber 9 and 18 are heat insulators which are prepared in the outside of a chamber 9 and maintain thermal cutoff with the exterior. If chamber 9 the very thing is constituted from an ingredient with adiabatic efficiency, for example, an ENJINI rear ring ceramic, the heat insulator 18 is unnecessary. Furthermore, as a low-fever expansive additive (trade name), for example, a zero joule, is used and the quality of the material of a chamber 9 is shown in drawing 5 , it is also possible to make it the measurement precision of direct installation and a laser interferometer 15 not receive the effect of the index of air for a laser interferometer 15 in the side face.

[0018] The oil-level gage 19 for measuring the height of a liquid 30, the thermometer 20 which measures the temperature of a liquid 30, and the temperature controller 21 are formed in the chamber 9 again. The pump 22 for controlling the height of a liquid 30 is further formed in the chamber 9. A pump 22 is equipped also with the function to circulate the liquid 30 by which temperature control was carried out, and the filter 23 for filtering the impurity in a liquid 30 is also set. In order that a measuring instrument for 24 to measure the refractive index of a liquid 30 and 25 may make a liquid 30 homogeneity, the ultrasonic excitation equipment installed in wafer 2 front face or the 2nd optical element 7 front face in order to prevent air bubbles adhering, and 26 are the vibration free pedestals of an aligner.

[0019] Next, actual actuation of the equipment of the above-mentioned configuration, an operation, effectiveness, etc. are explained. In case it exposes, after picking out the wafer 2 which has applied the sensitization agent beforehand from the wafer cassette 10 and carrying and rough-positioning it by the wafer transport device 11-1 first in the wafer location rough detection device 11-2 (it is usually called the PURIARAIMENTO device), a wafer 2 is handled by the wafer sending hand 11-3, and a wafer 2 is set on the wafer chuck 12 installed in the chamber 9. Flat-surface correction of the wafer 2 carried on the wafer chuck 12 is fixed and carried out by vacuum adsorption. The liquid 30 for immersion which could come, simultaneously was controlled by the temperature controller 21 by constant temperature is sent in in a chamber 9 through a filter 23 with the transportation pump 22. If a liquid 30 becomes a predetermined amount, the oil-level gage 19 will detect this and will suspend a pump 22.

[0020] When it is monitoring continuously with the temperature sensor 20 and shifts from predetermined temperature, the temperature of a liquid 30 operates the transportation pump 22 again, and circulates the liquid 30 of constant temperature. Homogeneous measurement is also performed by refractometry equipment 24, although a flow of a liquid 30 by circulation of a liquid 30 takes place and the homogeneity of a liquid 30 collapses in that case. Moreover, the air bubbles in a liquid 30, the air bubbles adhering to wafer 2 front face, and the air bubbles adhering to the 2nd optical element 7 front face operate ultrasonic excitation equipment 25, and are removed. The effectiveness made into homogeneity also has liquid 30 the very thing, this ultrasonic excitation has the small amplitude of vibration, and since the frequency is high, it does not influence positioning or exposure of a wafer 2.

[0021] If the homogeneity of a liquid 30 is checked with refractometry equipment 24, precision positioning (the alignment, focus, etc.) and exposure of a wafer 2 will be performed like the usual aligner. Although a flow of a liquid 30 occurs by step-and-repeat actuation at this time, spacing of the 2nd optical element 7 and wafer 2 front face is several mm to about dozens of mm, and a flow of the liquid 30 of this part disappears from a liquid 30 having viscosity comparatively for a short time. Therefore, what is necessary is to take a time delay after a step for every shot, or to measure the flow condition of the liquid 30 of this part with

refractometry equipment 24, and just to make a sequence continue, when a flow stops. Moreover, since the periphery of a chamber 9 is covered with the heat insulator 18, time amount extent which processes one wafer needs to operate the transportation pump 22, and does not usually need to circulate the liquid 30 of constant temperature.

[0022] If exposure of the whole surface of a wafer 2 is completed, the transportation pump 22 will operate again to this and coincidence, and it is begun to discharge the liquid 30 in a chamber 9. A transportation pump is stopped, when the oil-level gage 19 is always detecting the height of a liquid 30 and the height of a liquid 30 becomes low slightly from the 12th page of a wafer chuck at this time. Therefore, the amounts of the liquid 30 to discharge are few. Then, the vacuum of the wafer chuck 12 is cut, and by the taking-out hand 11-4, the wafer 2 on the wafer chuck 12 is handled, and it contains to the wafer cassette 10. Both sides of a wafer 2 are blown with clean air, and you may make it remove a liquid 30 from wafer 2 front face just before receipt at this time.

[0023] The block diagram of the immersion type projection aligner which example 2 drawing 11 requires for the 2nd example of this invention, the sectional view of the wafer chuck [in / in drawing 12 / drawing 11] 12, and drawing 14 are the mimetic diagrams showing the modification of the stage part in drawing 11 . Set to these drawings and a fluid bearing guide for conveyance opening for 31 to carry in and take out a wafer 2 in a chamber 9 and 32 to make the jogging stage 14 movable horizontally and 33 make the interior of a chamber 9 negative pressure. The vacuum pump for removing the air bubbles in a liquid 30, the bulb by which 34 was connected to the vacuum pump 33, In order that 35 may remove a liquid 30, a manometer for Blois which has a nozzle for spraying clean air on wafer 2 front face, and 36 to measure the internal pressure of a chamber 9, and 37 are the shutter styles built in the wafer chuck. Although other configurations are the same as that of the case of drawing 1 , a seal 8 also has the function to which the secrecy of a chamber 9 is maintained. Moreover, in addition to the function to circulate a liquid 30, a pump 22 is equipped also with the function to control the pressure of a liquid 30.

[0024] In this configuration, when [each] conveying a wafer 2 and taking out into a chamber 9 as a point that the case and actuation of an example 1 differ from each other, closing motion of the conveyance opening 31 is performed. Moreover, after setting a wafer 2 on the wafer chuck 12, carrying out specified quantity **** of the liquid 30 and suspending a pump 22, the vacuum pump 33 linked to the vacuum chamber 9 operates further, and the air bubbles in a liquid 30 are removed. At this time, ultrasonic excitation equipment 25 is operated to coincidence, and the air bubbles in a liquid 30, the air bubbles adhering to wafer 2 front face, and the air bubbles adhering to the 2nd optical element 7 front face are also removed. If it finishes removing air bubbles, it will stop, the bulb 34 connected to coincidence at this will also be closed, a pump 22 will operate, and a vacuum pump 33 will begin to pressurize a liquid 30. And when the pressure of the pressure gage 36 which has measured the internal pressure of a chamber 9 shows a predetermined value, temperature of the liquid 30 by the temperature sensor 20 is continuously monitored like the case of an example 1. Moreover, just before containing to the wafer cassette 10, both sides of a wafer 2 are blown with clean air with bulla 35, and a liquid 30 is removed from a wafer front face. Other actuation is the same as that of the case of an example 1.

[0025] According to this, since the liquid 30 is pressurized, a flow of the liquid 30 by step-and-repeat actuation disappears more for a short time. Moreover, it is possible to also make the flat-surface correction capacity of the wafer 2 on the wafer chuck 12 increase with the pressure of the pressurized liquid 30.

[0026] Example 3 drawing 12 is the sectional view of the wafer chuck part of the immersion type aligner concerning the 3rd example of this invention. Fill [the liquid 30], it enables it to process here, as a shutter is opened and vacuum adsorption is carried out, only when the shutter style 37 is added to the wafer chuck 12 and a wafer 2 is on the wafer chuck 12, as shown in drawing 12 although it flows and he is trying to discharge a liquid for every wafer in ****. Thereby, improvement in a throughput is achieved. In this case, the wafer 2 conveyed is inserted by the wafer sending hand 11-3 into a liquid 30 so that air bubbles may not remain aslant or perpendicularly to a liquid 30, it is leveled in a liquid 30, and is set on the wafer chuck 12.

[0027] Example 4 drawing 6 is the sectional view showing the stage part of the immersion type aligner concerning the 4th example of this invention. In the configuration of an example 1, in order to prevent an impurity mixing into a liquid 30, this is constituted so that the drive system of X-Y stage 13 may be put on the exterior of a chamber 9. In this case, as shown in this drawing, the X-Y stage 13 whole is arranged besides a chamber 9, carries a chamber 9 on X-Y stage 13, and is positioned the whole chamber 9. In this case, since the liquid 30 of the chamber 9 interior flows with the acceleration at the time of migration in order to carry out step-and-repeat actuation of the liquid 30 whole, the stabilizer 29 which combined the plate as shown in drawing 7 in the shape of a mesh is inserted into a liquid 30 at the time of a step, and it has

the structure where a flow and ****** of a liquid 30 can be pressed down. In addition, the same stage configuration is applicable also to the configuration of an example 2. Moreover, you may make it the configuration where the hole for letting the projection lens 4 pass for a stabilizer 29 at the core as shown in drawing 13 was prepared.

[0028] Example 5 drawing 8 is the sectional view showing the stage part of the immersion type aligner concerning the 5th example of this invention. In the configuration of an example 1, in order to prevent an impurity mixing into a liquid 30, this is constituted so that the drive system of X-Y stage 13 may be put on the exterior of a chamber 9 like the case of an example 4. However, it constitutes so that the jogging stage 14 in a chamber 9 may be made to drive indirectly in this case by arranging a magnet 27 on the base of the jogging stage 14, constituting the base of a chamber 9 from an ingredient of permeability, making it combine with the magnet 28 on X-Y stage 13 in the lower part of a chamber 9 magnetically, and moving X-Y stage 13 for the base of a chamber 9 as a guide of the jogging stage 14, as shown in this drawing.

[0029] Example 6 drawing 14 is the sectional view showing the stage part of the immersion type aligner concerning the 6th example of this invention. In order to prevent an impurity mixing this into a liquid 30 in the configuration of an example 2 Put the drive system of X-Y stage 13 on the exterior of a chamber 9 like the case of an example 5, arrange a magnet 27 on the base of the jogging stage 14, and the base of a chamber 9 is constituted from an ingredient of permeability. By making it combine with the magnet 28 on X-Y stage 13 in the lower part of a chamber 9 magnetically, and moving X-Y stage 13 for the base of a chamber 9 as a guide of the jogging stage 14, it constitutes so that the jogging stage 14 in a chamber 9 may be made to drive indirectly. Furthermore, as the nozzle which blows off a liquid is prepared in jogging stage 14 inferior surface of tongue and the liquid 30 currently used for dipping is made to blow off from there, the fluid bearing guide 32 is constituted. Thereby, since mass for moving part at the time of step-and-repeat actuation can be made light, a throughput can be raised further.

[0030] Example 7 drawing 9 is the sectional view showing the stage part of the immersion type aligner concerning the 7th example of this invention. This arranges only the part containing the wafer chuck 12 in a chamber 9, or constitutes the wafer chuck 12 directly on the base of a chamber 9, and arranges a chamber 9 on the jogging stage 14. In this case, it is also possible to constitute these from a low-fever expansion ingredient so that the 2nd page which adjoins the base of a chamber 9 and this may become a right angle, respectively, and to consider as this reference side for [2nd page] measurement of a laser interferometer 15.

[0031] In addition, in above-mentioned each example, the transport device for carrying in a wafer on the wafer chuck 12, or taking out a wafer from on a chuck 12 can also be constituted [constituting in a chamber 9, and] besides a chamber 9.

[0032]

[Effect of the Invention] As explained above, according to this invention, the immersion method which raises resolution and the depth of focus can be applied now to an aligner in the mode which can be used for the ten sections by the actual production process. Therefore, irrespective of wavelength of the exposure light source, such as g line, i line, or excimer laser, the cheap immersion type aligner of the cost which can expect the effectiveness according to each wavelength can be offered on every wavelength, and the immersion type aligner which can employ the further conventional process technique efficiently can be offered.

[Translation done.]

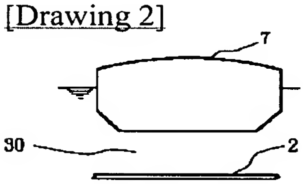
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

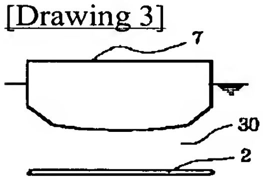
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

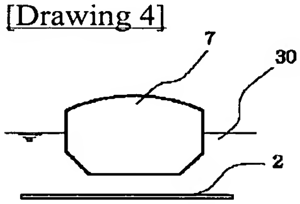
[Drawing 2]



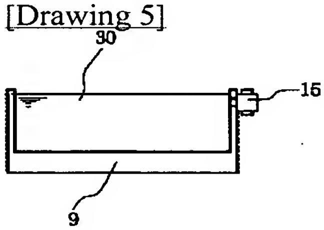
[Drawing 3]



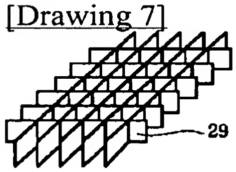
[Drawing 4]



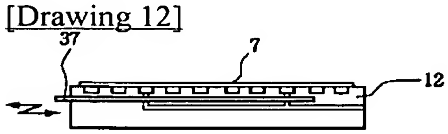
[Drawing 5]



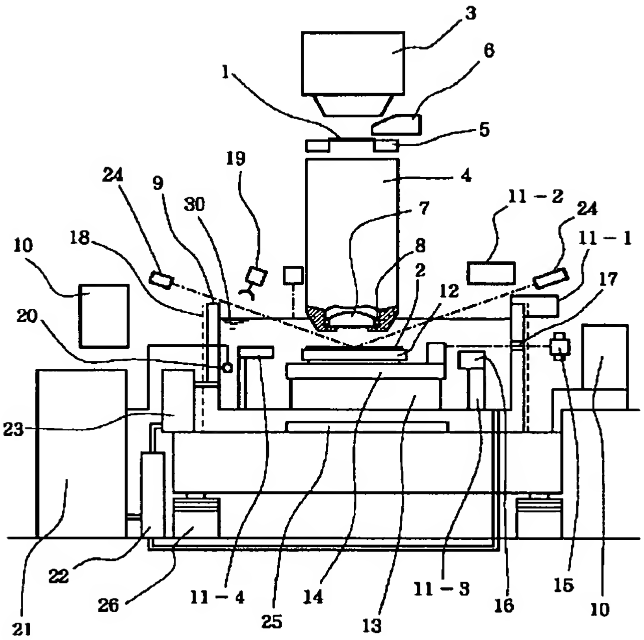
[Drawing 7]



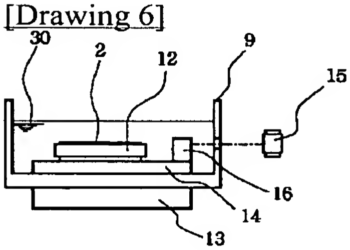
[Drawing 12]



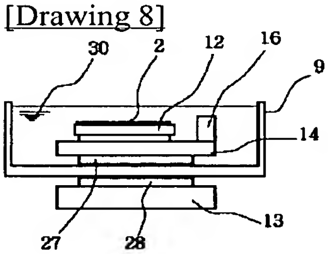
[Drawing 1]



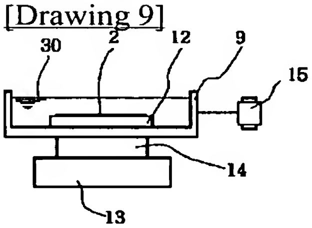
[Drawing 6]



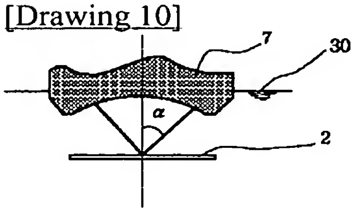
[Drawing 8]



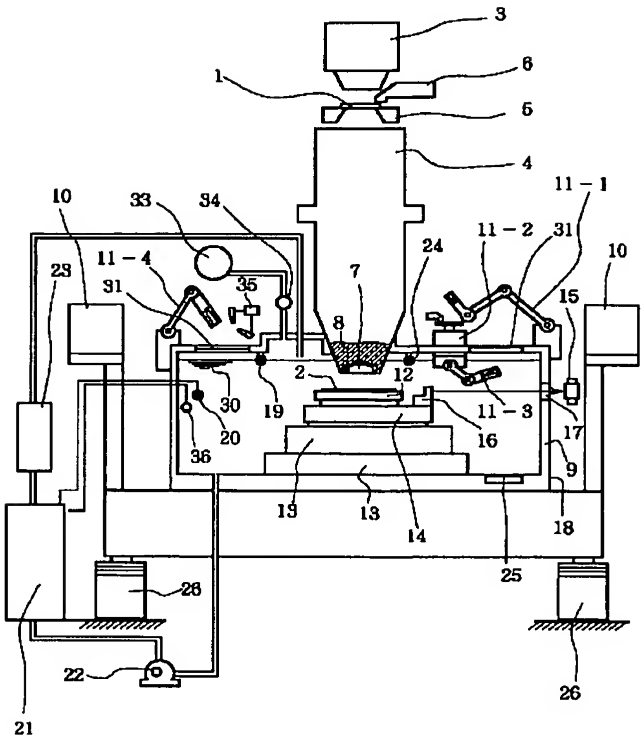
[Drawing 9]



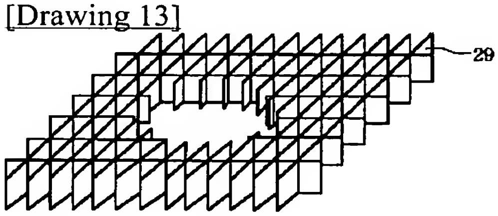
[Drawing 10]



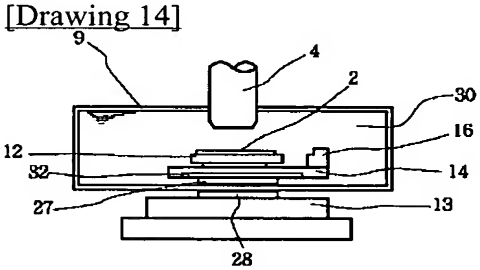
[Drawing 11]



[Drawing 13]



[Drawing 14]



[Translation done.]